

ADDITIONS TO THE LICHEN FLORA OF KERALA STATE I : PARMELIOID MACRO LICHENS

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ABSTRACT

The paper gives an account of ten lichen species belonging to Parmelioid lichen group. Of these, *Bulbothrix tabacina*, *Hypotrachyna radiculata*, *Hypotrachyna rhabdiformis*, *Parmotrema pseudocrinitum* and *Parmotrema robustum* are new to Peninsular India, and *Hypotrachyna boquetensis*, *Myelochroa indica*, *Myelochroa perisidians*, *Parmotrema andinum* and *Parmotrema melanothrix* are new to Kerala.

INTRODUCTION

The Parmelioid lichens are characterized by foliose or subcrustose, dorsiventral, heteromerous, glaucous white, grey, yellow grey to green, grey brown, olivaceous brown to dark brown thallus, paraplectenchymatously corticated on both sides, with or without pored epicortex, compact medulla, lower surface with simple to dichotomously or squarrosely branched rhizines, lecanorine, sessile to pedicellate laminal apothecia with 8-spored asci, simple, hyaline, oval to ellipsoid spores, laminal immersed pycnidia with cylindrical to bacilliform, bifusiform, fusiform, sublageniform, unciform or filiform conidia. It comprises of 22 genera, represented by 192 species in India which is ca 11% of the total Parmelioid taxa known from the world and 10.6% of the total known taxa from India. Out of the 192 species known from India, about 20 species seems to be endemic and 3 species are possibly extinct, which is about 10.6% of the total known taxa from this region. Within the Indian subcontinent, 46 species exhibit their restricted distribution in South Indian region followed by Eastern Himalayas with 37 in central and in north and west Himalayas (Divakar & Upreti, 2005).

As in the case of higher plants, Western Ghats part of Kerala holds a good number of lichens in its various micro climatic pockets. Western Ghats is ranked sixth among the eight lichenological regions and ranked first in the total number of species confined to this

hotspot centre. Even though, the entire area has not been fully explored for the lichen inventory, there is a rich diversity of lichens from various hotspots of Western Ghats. Only casual or cursory collections have been made from most of the Western Ghats region (Kumar, 2000).

Patwardhan (1983) and Negi (2000) reported about 800 lichen species from Western Ghats. However, Kumar & Stephan (1999) enumerated 711 species of lichens from this mega endemic centre from the States of Maharashtra, Karnataka, Tamil Nadu and Kerala based on a survey of all the available literature. About 462 species comprising 83 genera belonging to 34 families of micro forms and 309 species in 38 genera belonging to 20 families of macro forms have been reported (Kumar & Stephan, 1999) which together include about 31 per cent of the total lichens occurring in India.

In our on-going research project on lichens in the Western Ghats of Kerala, we have so far determined 61 species of lichens belonging to the family Parmeliaceae. Careful search of literature revealed that out of these 61 species, 5 taxa are new to Peninsular India and 5 are new to Kerala. Species referred in the text are deposited both at the herbaria of Tropical Botanic Garden and Research Institute (TBGT) and National Botanical Research Institute (LWG).

MATERIALS AND METHODS

The survey and collection of specimens were made periodically covering all seasons. Specimens were collected from evergreen forest areas at an altitude of 700 m to 1870 m. The lichens that are loosely attached to the substratum were scrapped and collected. Sufficient amount of lichens were collected, as some materials was to be consumed for chemical analysis for TLC and microscopic study. The collected specimens were

numbered and labeled with details like date of collection, locality, altitude and substratum. The lichen specimens were transferred to newspaper or blotter packets along with their labels for drying. The newspaper and blotting papers are changed at regular intervals and during rainy season, samples were air dried at room temperature or oven dried. The samples on wet barks were kept in plant press and tied tightly. Much dried and curled specimens were stretched using water and by spreading on blotters. The lichen herbarium packets were made up of thick white handmade paper. The herbarium label containing the information of name and family of the lichen, herbarium number, date of collection, detailed locality, altitude and collectors name is pasted on herbarium packets. The lichen specimens were identified by studying their external and internal morphology and chemistry. The identification of all the taxa was done by referring to the keys and standard descriptions available from the literature. Identification of some taxa were confirmed by matching them with types, exciccates and well identified materials housed at lichen herbarium (LWG) of National Botanical Research Institute (NBRI), Lucknow. After complete identification of lichens, the specimens were housed at herbarium of TBGT (TBGT) and a set of voucher specimens are housed at NBRI (LWG).

TAXONOMY

1. *Bulbothrix tabacina* (Mont. & Bosch) Hale in Phytologia 28: 481. 1974. (Fig. 1)

Parmelia tabacina Mont. & Bosch in Montagne, Syll. Gen. Sp. Crypt. 327. 1856.

Thallus closely appressed to the substratum, 3.0-5.0 cm across. Lobes 1.0-3.0 mm wide, 100-120 μ m thick, margins crenate, with bulbate cilia. Cilia dense, bulb conspicuous, short, 0.5-1 mm long. Upper surface grey, isidiate, plane. Isidia laminal, cylindrical, up to 0.5 cm long. Medulla white, 60-80 μ m thick. Lower surface black, with brown mar-

ginal zone. Rhizines black, simple, more towards central part. Apothecia and pycnidia not seen.

Chemistry: Cortex K + yellow; medulla K + yellow turning red, C-, KC-, and P+ orange. TLC: Salazinic acid present.

Remarks: *B. tabacina* is characterised by isidiate, maculate thallus, black lower surface and presence of salazinic acid. In chemistry and morphology the taxon is similar to *B. isidiza*, but differs in having black lower surface (Divakar & Upreti, 2005).

Distribution: It has pan tropical distribution in Guinea, Indonesia, Jamaica, Mexico, Nepal, Philippines, South Africa, Tanzania, Tobago (Hale, 1976 a, b), and Taiwan (Kurokawa & Lai, 2001). In India, the species exhibits its restricted distribution to subtropical regions like Maharashtra, Manipur, Nagaland and Uttaranchal (Awasthi, 2007). It is a new record to Peninsular India.

Specimens examined: Ponmudi, Trivandrum, S. Shaju, January 19, 2006, LWG 06- 007880, TBGT 62c; Thattekkad Bird Sanctuary, Ernakulam, Kerala, Alt. 400m, H. Biju, December 21, 2006, LWG 06- 007885, TBGT 1546.

2. *Hypotrachyna boquetensis* (Hale) Hale in Smiths. Contr. Bot. 25: 25 . 1975. (Fig. 2)

Parmelia boquetensis Hale in Phytologia 28: 265, 1974.

Hypotrachyna coorgiana Patw. & Prabhu in Bryologist 80(2): 348. 1977.

Thallus closely attached to the substratum, up to 8cm long, irregularly lobed. Lobes sinuate, 3-5 mm wide, 150-170 μ m thick; margins crenate, eciliate. Upper surface grey, smooth, both isidia and soredia absent. Medulla white, 90-120 μ m. Lower surface black, with 2-3 mm wide, erhizinate marginal zone. Rhizines few, short, simple to dichotomously branched, up to 1mm long. Apothecia numerous, 3-6 mm in diameter; disc concave, red brown, amphithecium smooth, rugose, epithecium brown, 10-12 μ m thick; hymenium 30-45 μ m high. Asci clavate, 8-spored, 30-40 x 12-15 μ m in size. Spores colourless, simple, oval, 6-12 x 4-6 μ m.

Chemistry: Cortex K + yellow; medulla K + yellow turning red, C -, KC -, P + orange. TLC: Salazinic acid present.

Remarks: *H. boquetensis* is characterised by closely adnate thallus on twigs, sub rotund lobes, large, numerous apothecia, absence of isidia and soredia, and presence of salazinic acid in medulla. In external morphology, nature of apothecia and colour reaction it closely resembles to *H. sublaevigata* (Nyl.) Hale, which differs in having pruinose apices and norstictic acid in medulla (Divakar & Upreti, 2005).

Distribution: In India, the taxon is distributed in Karnataka and Tamil Nadu (Divakar & Upreti, 2005). Out side India, it is also reported from Panama (Hale, 1975). It is a new record to Kerala.

Specimens examined: Silent Valley National Park, Palghat, Alt.1020m, P. S. Jothish, October 22, 2005, LWG 05-007888, TBGT 68; Alt.1010m, P. S. Jothish, October 27, 2005, LWG 05-007927, TBGT 44; Alt. 1020 m, P. S. Jothish, April 21, 2006, LWG 06-008151, TBGT 434.

3. *Hypotrachyna radiculata* (Kurok.) Elix in Australian Lichenology 48 : 16. 2001. (Fig. 3)

Parmelia radiculata Kurok., Studies Crypt. Papua New Guinea 139. 1979.

Thallus attached to the substratum, 4-6 cm across. Lobes dichotomously branched, 1-2 mm wide, 120-180 μ m thick; margins dentate, ciliate. Cilia simple, few, 0.5 mm long. Upper surface grey, smooth, emaculate, sorediate. Soralia marginal, confluent. Medulla white, 80-100 μ m thick. Lower surface black, rhizinate. Rhizines simple to dichotomously branched, 1-1.5 mm long. Apothecia and Pycnidia not seen.

Chemistry: Cortex K + yellow; medulla K + red, C -, KC -, P + orange. TLC: Zeorin and salazinic acid present.

Remarks: *H. radiculata* is characterised by sub marginal, capitate soralia, ciliate margin and presence of salazinic acid and zeorin in the medulla. In external appearance the species is similar to *H. pseudospeciosa* (Asah.) Hale, which differs in having protocetraric acid in the medulla. It is also similar to *H. majoris* (Vainio) Hale, since both the species have sorediate upper surface and salazinic acid and zeorin in the medulla. However, *H. majoris* differs in having eciliate margin (Divakar & Upreti, 2005).

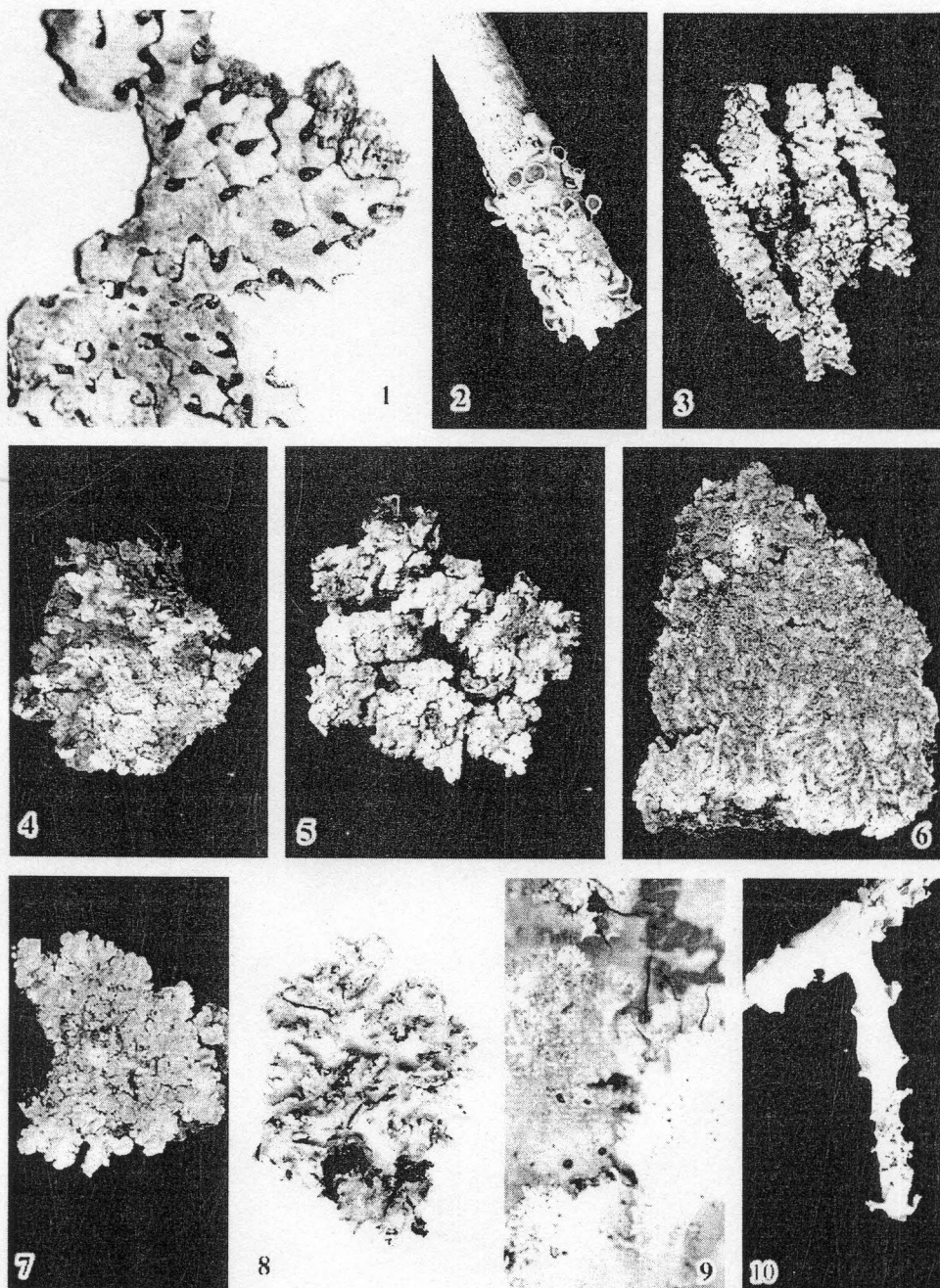


Fig. 1. *Bulbothrix tabacina* (Mont. & Bosch) Hale; Fig. 2. *Hypotrachyna boquetensis* (Hale) Hale; Fig. 3. *Hypotrachyna radiculata* (Kurok.) Elix; Fig. 4. *Hypotrachyna rhabdiformis* (Kurok.) Hale; Fig. 5. *Myelochroa indica* (Hale) Elix & Hale; Fig. 6. *Myelochroa perisidians* (Nyl.) Elix & Hale; Fig. 7. *Parmotrema andinum* (Mull. Arg.) Hale; Fig. 8. *Parmotrema melanothrix* (Mont.) Hale; Fig. 9. *Parmotrema pseudocrinitum* (des Abb.) Hale; Fig. 10. *Parmotrema robustum* (Degel.) Hale.

Distribution: The species is known from Panama (Hale, 1975). In India, the taxon is distributed in Sikkim and Kumaon Himalayas (Divakar & Upreti, 2005). It is a new record to Peninsular India.

Specimens examined: Periyar Tiger Reserve, Thekkadi, Idukki, *H. Biju*, March 22, 2006, LWG 06-007978, TBGT 365; Athirumala, ABP, Trivandrum, Alt. 1000m, *H. Biju*, April 27, 2006, LWG 06-008170, TBGT 509; Mukkampara, Sholayar range, Thrissur, Kerala, Alt. 450m, *H. Biju*, September 28, 2006, LWG 06-008281, TBGT 1034.

4. *Hypotrachyna rhabdiformis* (Kurok.) Hale in Smiths. Contr. Bot. 25: 62. 1975. (Fig. 4)

Parmelia rhabdiformis Kurok. in Hale and Kurok. in Contr. U. S. Nat. Herb. 36: 183. 1964.

Thallus attached to the substratum, 4 cm across, irregularly lobed. Lobes sub linear, 2-5 cm wide. Upper surface grey, shining, emaculate, isidiate. Isidia simple, cylindrical, mostly in groups. Medulla white. Lower surface black, rhizinate. Rhizines simple to dichotomously branched. Apothecia and Pycnidia not seen.

Chemistry: Cortex K + yellow; medulla K + yellow-red, C -, P + orange. TLC: Norstictic acid present.

Remarks: In external morphology and K + yellow-red reaction of medulla it resembles *H. crenata*, but differs in having mostly simple, clavate isidia and presence of norstictic acid. However, *H. crenata* has stictic acid as major medullary compound (Divakar & Upreti, 2005).

Distribution: The taxon was exhibiting its restricted distribution in Himalayan region of Nepal and India (Divakar & Upreti, 2005). Outside India it is also known from Panama, Peru and Southeast Asia (Hale, 1975). It is a new record to Peninsular India.

Specimens examined: Silent Valley National Park, Palghat, Alt. 1010m, *P.S. Jothish*, January 15, 2006, LWG 06-007924, TBGT 1252g; Kochupamba, Pathanamthitta, *H. Biju*, March 21, 2006, LWG 06-007887, TBGT 410; Pongalappara, ABP, Trivandrum, Alt. 1320m, *H. Biju*, April 26, 2006 LWG 06-007922, TBGT 450c; Begur Range, Thirunelli, Wayanad, Kerala, Alt. 830m, *H. Biju*, May 17, 2006, LWG 06-007886, TBGT 630.

5. *Myelochroa indica* (Hale) Elix & Hale in Mycotaxon 29: 241. 1987. (Fig. 5)

Parmelia indica Hale in Smiths. Contr. Bot. 33: 34. 1976.

Thallus closely attached to the substratum, 2-3mm across. Lobes irregular, sublinear, 1-2 mm wide, 80-100 μ m thick; margins entire, ciliate. Cilia simple, black, up to 3mm long. Upper surface grey, smooth near periphery, isidiate. Isidia cylindrical, simple to branched. Medulla white, 50-60 μ m thick. Lower surface black, densely rhizinate. Rhizines simple, black, up to 5mm long. Apothecia and Pycnidia not seen.

Chemistry: Cortex K + yellow; medulla K -, C -, KC-, P -. TLC: Triterpene present.

Remarks: *M. indica* is a very distinctive species in having isidiate thallus, leucotylin and lacking medullary pigmentation. In isidiate morphology, it is similar to *M. perisidians*, which differs in having yellow pigmented medulla. It is the only triterpene containing species of the genus without pigments (Divakar & Upreti, 2005).

Distribution: Earlier the species was reported from its type locality in Kodaikanal, Palni hills of Tamil Nadu (Hale, 1976a, b), but Park (1990) also reported this taxon from South Korea. It is reported here for the first time from Kerala.

Specimens examined: Mattupetty, Munnar, Idukki, Kerala, Alt. 1580m, *H. Biju*, July 26, 2006, LWG 06-007555, TBGT 937a.

6. *Myelochroa perisidians* (Nyl.) Elix & Hale in Mycotaxon 29: 241. 1987. (Fig. 6)

Parmelia perisidians Nyl. in Acta Soc. Sci. Fenn. 26: 6. 1900.

Parmelina perisidians (Nyl.) Hale in Phytologia 28: 483. 1974.

Thallus closely attached to the substratum, 3-4 cm. Lobes short, 0.5-1mm wide, 100-120 μ m thick, margins ciliate. Cilia few, confined to axils, 0.5 mm long. Upper surface grey, smooth, emaculate, densely isidiate. Isidia cylindrical, simple to slightly branched, 0.5-1mm long. Medulla yellow, 50-60 μ m thick. Lower surface black, moderately rhizinate. Rhizines black, simple to branched, 0.5-1mm long. Apothecia and Pycnidia not seen.

Chemistry: Cortex K + yellow; medulla more intensely yellow with K, C, KC, and P. TLC: No Chemical substance seen.

Remarks: *M. perisidians* is characterised by densely isidiate upper surface and yellow coloured medulla. In isidiate morphology, it is similar to *M. indica*, but differs in having yellow medulla (Divakar & Upreti, 2005).

Distribution: In India the species is distributed in Karnataka, Manipur, Nagaland, Sikkim and Tamil Nadu (Divakar & Upreti, 2005). It is also known from Japan, Thailand and Sri Lanka (Kurokawa & Arakawa, 1997). It is a new record to Kerala.

Specimens examined: On the way to Chembra Hills, Wayanad, Alt. 1100m, *H. Biju*, May 16, 2006, LWG 06- 008385, TBGT 645c; On the way to Mattupetty, Munnar, Idukki, Alt. 1580m, *H. Biju*, July 26, 2006, LWG 06- 007977, TBGT 936b.

7. *Parmotrema andinum* (Müll. Arg.) Hale in *Phytologia* 28: 334. 1974. (Fig. 7)

Parmelia andina Müll. Arg. in *Rev. Mycol.* 1: 169. 1879.

Parmelia mallii Ras., *Arch. Soc. Zoll. Bot. Fenn* 'Vanamo' 6(2):81. 1951.

Thallus foliose, loosely attached to the substratum, 4.5-13 cm across. Lobes ascending, rotund, up to 5-10 mm wide, 120-180 μm thick; margin crenate, eciliate. Upper surface ashy white to grey, smooth, maculate, without isidia, soredia and pustules. Medulla white, 100-120 μm thick. Lower surface black, slightly wrinkled, with 3-5 mm wide, erhizinate marginal zone. Rhizines in the centre, simple, short up to 1mm long. Apothecia rare, stipitate, up to 10mm in diameter, disc brown, amphithecium rugose, maculate, epithecium brown, 15-20 μm thick; hymenium 55-65 μm high. Asci clavate, 8-spored, 30-45 x 19 μm . Spores colourless, simple, ellipsoid, 14-22 x 7-10 μm . Pycnidia laminal, towards apices, black. Conidia filiform, 10-15 μm long.

Chemistry: Cortex K+ yellow; medulla K -, C+ red, KC + red, P -. TLC: Lecanoric acid present.

Remarks: *P. andinum* is easily distinguished by the non-isidiate, non-sorediate thallus, eciliate margin and C+ red medulla due to lecanoric acid. It

closely resembles to *P. holobum* (Hale) Hale, but differs in the absence of marginal cilia (Divakar & Upreti, 2005).

Distribution: In India the taxon is distributed in Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Tamil Nadu and North Himalayan regions of Uttaranchal (Divakar & Upreti, 2005). Outside India, it is known from numerous localities in continental Africa and Madagascar, Thailand and South America (Krog & Swinscow, 1981). It is a new record to Kerala.

Specimens examined: Pamba Dam site, Pathanamthitta, Kerala, March 21, 2006, *H. Biju*, LWG 06-008145, TBGT 414.

8. *Parmotrema melanothrix* (Mont.) Hale in *Phytologia* 28: 337. 1974. (Fig. 8)

Parmelia urceolata var. *melanothrix* Mont. in *Ann. Sci. Nat. Bot. Ser.* 2, 2: 372. 1834.

Parmelia melanothrix (Mont.) Vainio in *Acta Soc. Faun. Fl. Fenn.* 7 : 30, 1890.

Thallus loosely attached to the substratum, 5-15 cm across. Lobes rotund, 7-9 mm wide, 180-220 μm thick; margins crenate, slightly dentate, densely ciliate. Cilia simple to slightly dentate, 1-2 mm long. Upper surface grey, maculate, isidia, soredia and pustules absent. Medulla white, 120-150 μm thick. Lower surface black, with 4-6 mm wide, erhizinate marginal zone. Rhizines in the centre, simple, up to 2 mm long. Apothecia few, 3-6 mm diameter, concave, margins dentate, epithecium brown, 10-12 μm thick; spores few, simple, oval, hyaline 20-22 x 10-12 μm .

Chemistry: Cortex K + yellow, medulla K -, C -, KC -, P -. TLC: No Chemical substance seen.

Remarks: *P. melanothrix* is distinguished by imperforate apothecia, large spore, maculate upper surface, ciliate margins, pale brown marginal zone on lower surface and negative medullary reaction. It is close to *P. nilgherrense* on outer appearance but the latter species is distinctly white maculate upper surface, perforate apothecia, dark tan margins on lower surface and KC+ pink or red reaction in medulla (Divakar & Upreti, 2005).

Distribution: The taxon is distributed both in South Indian and Himalayan regions of India in Andhra Pradesh, Himachal Pradesh and

Uttaranchal (Awasthi, 2007). Outside India, it is also known from Brazil, Reunion Island (Hale, 1965). It is a new record to Kerala.

Specimens examined: Top Station, Ponmudi, Trivandrum, Kerala, *H. Biju*, June 23, 2006, LWG 06-007819, TBGT 616.

9. *Parmotrema pseudocrinitum* (des Abb.) Hale in *Phytologia* 28: 338. 1974. (Fig. 9)

Parmelia pseudocrinita des Abb. in *Bull. Inst. Fr. Afr. Noire* 20 : 19. 1958.

Thallus coriaceous, attached to the substratum, 5-12 cm across. Lobes imbricate, 6-12 mm wide, 100-220 μ m thick, margins ciliate. Cilia evenly distributed, 1-2 mm long. Upper surface mineral grey, smooth, emaculate, isidiate. Isidia laminal, dense, cylindrical to coralloid, 0.5-1 mm long. Medulla white, 60-150 μ m thick. Lower surface black, erhizinate marginal zone. Rhizines simple, restricted to the centre, 1-2 mm long. Apothecia and Pycnidia not seen.

Chemistry: Cortex K + yellow, medulla K -, C + rose, KC + red, P -. TLC: Gyrophoric acid present.

Remarks: *P. pseudocrinitum* is characterised by emaculate, isidiate upper surface, ciliate margins and presence of gyrophoric acid in the medulla. In isidiate and ciliate condition of thallus it is similar to *P. crinitum* which differs in having stictic acid complex in the medulla (Divakar & Upreti, 2005).

Distribution: In India the taxon exhibits its restricted distribution in Eastern Himalayas and known from different localities of Nagaland (Divakar & Upreti, 2005). Outside India, it is known from eastern and southern Africa (Krog & Swinscow, 1981); Thailand (Wolseley *et al.*, 2002). It is a new record to Peninsular India.

Specimens examined: Cheveloda, Periyar Tiger Reserve, Thekkadi, Idukki, Kerala, *H. Biju*, March 22, 2006, LWG 06-008063, TBGT 211.

10. *Parmotrema robustum* (Degel.) Hale in *Phytologia* 28: 338. 1974. (Fig. 10)

Parmelia robusta Degel., *Göt. Kungl. Vet. Samh. Handl. Ser. B, Mat. Naturvetensk. Skr. ser.* 6(1): 33. 1941.

Thallus loosely attached to the substratum, 5-10 cm across. Lobes rotund, 5-8 mm wide, 200-220 μ m thick; margins entire, ciliate. Cilia few, 1-2 mm long. Upper surface grey, smooth, slightly maculate, sorediate. Soralia marginal, short, soredia granular. Medulla white, 90-120 μ m. Lower surface black, 2-5mm wide, erhizinate marginal zone. Rhizines few, restricted to the central part, simple, black, 1-2 mm long. Apothecia and Pycnidia not seen.

Chemistry: Cortex K + yellow, medulla K + yellow, C -, KC -, P + orange red. TLC: Protocetraric acid present.

Remarks: *P. robustum* is characterised by loosely adnate, membranous thallus, with sparse cilia, marginal soralia, black lower surface and protocetraric acid in medulla. In marginal soralia and presence of protocetraric acid, it is close to *P. dilatatum* which has eciliate lobe margins and traces of usnic acid in cortex. It also resembles *P. subarnoldii* which differs in having dense cilia on lobe margins as well as regular linear soredia on broad lobes (Divakar & Upreti, 2005).

Distribution: The taxon shows its restricted distribution in Eastern Himalayan ranges and known from Assam in the country (Divakar & Upreti, 2005). Outside India, it is also known from Australia, southern Europe, Canary Island, New Zealand, Papua New Guinea and Thailand (Wolseley *et al.*, 2002). It is a new record to Peninsular India.

Specimens examined: Periyar Tiger Reserve, Idukki, Kerala, *H. Biju*, March 23, 2006, LWG 06-007890, TBGT 191.

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